High-Mu Triode

NUVISTOR TYPE

ENVIRONMENTAL TESTS | LIFE TESTS

For Condenser-Microphone Preamplifiers, Piezoelectric- and Ceramic-Pickup Preamplifiers, and Other Voltage Amplifier Applications Requiring Amplification of Extremely Small Signals at DC to 200 kc/s

ELECTRICAL CHARACTERISTICS

Bogey Values

Heater Voltage, (DC or AC)	E_f	6.3	V
Heater Current at E_f = 6.3 V	I_f	100	mA
Heater Input	P_f	0.63	W
Direct Interelectrode Capacitances			
Without external shield			
Input: G to (K, S, H)	c_i	3.4	pF
Output: P to (K, S, H)	c_o	1.7	pF
Plate to cathode	c_{pk}	0.20	pF
Grid to cathode	c_{gk}	2.6	pF
Heater to cathode	c_{hk}	1.0	pF

CLASS A1 AMPLIFIER

For Following Characteristics see Conditions

Amplification Factor	μ	127	
Plate Resistance (Approx.)	r_p	41	kΩ
Transconductance	g_m	3100	µmho
DC Plate Current	I_b	1.5	mA
Cutoff DC Grid Voltage for I_b = 10 µA	$E_{c(co)}$	-1.7	V

Conditions

Heater Voltage	E_f	6.3	V
Plate Supply Voltage	E_{bb}	120	V
Grid Supply Voltage	E_{cc}	0	V
Cathode Resistor	R_k	200	Ω
Metal Shell	Connected to system ground		

ABSOLUTE MAXIMUM RATINGS

For operation as a Class-A1 Amplifier Tube at frequencies up to 200 kc/s

Plate Supply Voltage	E_{bb}	330	V
DC Plate Voltage	E_b	250	V
Grid Voltage			
Peak positive value	e_{cm}	0	V
DC positive value	E_c	0	V
DC negative value	E_c	-55	V
Peak Heater-Cathode Voltage	e_{hkm}	±100	V
Heater Voltage, DC or AC	E_f	5.7 to 6.9	V
Instantaneous Voltage Between base pins and metal shell	See *Breakdown-Voltage Characteristics Curve*		
Average Cathode Current	$I_{k(av)}$	2	mA
Plate Dissipation	P_b	0.3	W
Envelope Temperature[c]	T_E	150	°C

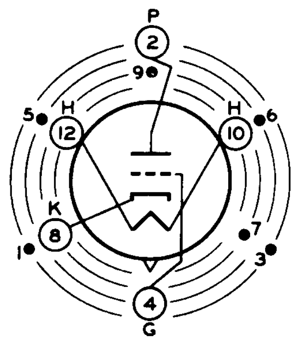
MAXIMUM CIRCUIT VALUES

Grid-Circuit Resistance			
For fixed-bias operation	$R_g(ckt)$	50	MΩ
For cathode-bias operation	$R_g(ckt)$	100	MΩ

MECHANICAL CHARACTERISTICS

Operating Position	**Any**
Type of Cathode	**Coated Unipotential**
Maximum Overall Length (l_m)	**0.800 in**
Maximum Seated Length (l_{sm})	**0.625 in**
Maximum Diameter (d_m)	**0.440 in**
Weight (Approx.)	**1.9 g**
Dimensional Outline	**JEDEC No.4-4**
Envelope	**JEDEC Designation MT4**
Base[a]	**Medium-Ceramic-Wafer Twelvar 5-Pin (JEDEC E5-65)**
Basing Designation for BOTTOM VIEW	**12AQ**

Pin 1[b] – Do Not Use
Pin 2 – Plate
Pin 3[b] – Do Not Use
Pin 4 – Grid
Pin 5[b] – Do Not Use
Pin 6[b] – Do Not Use
Pin 7[b] – Do Not Use
Pin 8 – Cathode
Pin 9[b] – Do Not Use
Pin 10 – Heater
Pin 11 – Omitted
Pin 12 – Heater



INDEX=LARGE LUG
●=SHORT PIN—IC

TYPICAL OPERATION

In High-Input-Impedance, Cathode-Follower Circuit

Heater Voltage	E_f	6.3	V
Plate Supply Voltage	E_{bb}	150	V
Cathode Bias Resistor (Bypassed) . . .	$R_k(bias)$	3.3	kΩ
Cathode Load Resistor	$R_k(load)$	15	kΩ
Grid Resistor	R_g	100	MΩ
Input Resistance (Approx.)	R_i	1	GΩ
Output Resistance (Approx.)			
Source resistance (R_S) = 1 GΩ. . . .	R_o	7	kΩ
Average Grid Current	$I_c(av)$	-0.1	nA
Average Plate Current	$I_b(av)$	0.3	mA

[a] Designed to mate with Cinch Mfg. Co. Socket No. 133 65 92 025, 133 65 91 034, or equivalent.

[b] Pins 1, 3, 5, 6, 7, and 9 are of a length such that their ends do not touch the socket insertion plane.

[c] Measured on metal shell in Zone "A" (See *Dimensional Outline*).

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INITIAL CHARACTERISTICS LIMITS

	Note	Min	Max	
Heater Current	1	90	110	mA
Direct Interelectrode Capacitances				
Grid to plate	2	-	0.7	pF
Input: G to (K, S, H)	2	3.0	3.8	pF
Output: P to (K, S, H)	2	1.5	1.9	pF
Plate to cathode	2	0.17	0.23	pF
Grid to cathode	2	2.2	3.0	pF
Heater to cathode	2	0.8	1.2	pF
Amplification Factor	3	95	160	
Transconductance	3	2200	4000	μmho
Plate Current	3	0.7	2.3	mA
Cutoff Plate Current	4	-	200	μA
AC Voltage Amplification	5	7	-	V
Total Grid Current	6	-	-0.05	μA
Heater-Cathode Leakage Current	7	-	±5	μA
Leakage Resistance				
Between grid and all other electrodes connected together	8	50	-	GΩ
Between plate and all other electrodes connected together	9	100	-	GΩ
Inoperatives	10	✓		

Note 1: With E_f = 6.3 V.
Note 2: Measured without external shield.
Note 3: With E_f = 6.3 V, E_{bb} = 120 V, E_{cc} = 0 V, R_k = 200 Ω, C_k = 1000 μF, metal shell grounded.
Note 4: With E_f = 6.3 V, E_b = 120 V, E_c = -1.7 V, metal shell grounded.
Note 5: With E_f = 6.3 V, E_{bb} = 120 V, E_{cc} = 0 V, R_g = 10 MΩ, $C_{c(in)}$ = 0.1 μF, grid-signal-source internal impedance < 2500 Ω, E_g = 0.2 V (rms, 60 c/s, sinewave), R_p = 0.5 MΩ, $C_{c(out)}$ = 0.5 μF. RMS voltage component measured across the series plate resistor with a 5 MΩ (min.) input impedance vacuum-tube voltmeter.
Note 6: With E_f = 6.3 V, E_b = 200 V, E_{cc} = -1 V, R_g = 1 MΩ, metal shell grounded.
Note 7: With E_f = 6.3 V, E_{hk} = ±100 V.
Note 8: With E_f = 6.3 V, $E_{g\text{-}all}$ = -100 V, metal shell grounded.
Note 9: With E_f = 6.3 V, $E_{p\text{-}all}$ = -300 V, metal shell grounded.
Note 10: Tubes are criticized for Shorts, Discontinuities, and Air Leaks.

ENVIRONMENTAL TESTS

High-Impact, Short-Duration Shock

Peak Impact Acceleration	1000	g
Duration of Approximate Half-Sine-Wave Mechanical-Shock Pulse	0.8 ± 0.2	ms

Operating Conditions during Test
E_f = 6.3 V, E_{bb} = 120 V, E_{cc} = 0 V, R_k = 200 Ω, R_g = 1 MΩ, E_{hk} = 100 V.

	Min	Max	
Post-Shock Limits and Rejection Criteria			
E_{Rp} (AC Voltage Amplification)	6	-	V
I_c	-	-0.1	μA
I_{hk}.	-	±10	μA
E_{Rpm} (Variable-Frequency-Vibration Test Limits) over Vibration-Frequency Range of:			
3 to 6 kc/s	-	50	mV
6 to 15 kc/s	-	1000	mV
Tap and Permanent Shorts, and Discontinuities. . .	√		

Low-Impact, Long-Duration Shock

Peak Impact Acceleration	50	g
Duration of Approximate Half-Sine-Wave Mechanical-Shock Pulse	11 ± 2	ms

Condition during Test
No tube-element voltages are applied.
Post-Shock Limits and Rejection Criteria
Same as those specified above for the High-Impact, Short-Duration Shock Test.

Sweep-Frequency-Vibration Fatigue

Vibration-Frequency Range (Overall)	5 to 500 to 5	c/s
Peak Displacement		
5 to 50 & 50 to 5 c/s	0.040	in
Peak-to-peak value	0.080	in
Peak Vibrational Acceleration.	10	g
50 to 500 to 50 c/s		
Period of 1 Sweep Cycle (Approx.)	15	m
5 to 500 to 5 c/s		
Duration of Test (Overall)	9	h
Along each of 3 mutually perpendicular axes .	3	h

Operating Condition during Test
$E_f = 6.3$ V
Post-Sweep-Frequency-Vibration-Fatigue Limits and Rejection Criteria
Same as those specified above for the High-Impact-Short-Duration Shock Test.

Variable-Frequency Vibration

Vibration-Frequency Range (Overall)	3 to 15	kc/s
Peak Vibrational Acceleration.	1	g
In X_1 position		
Period of 1 Sweep Cycle (3 to 15 kc/s)	7	s

Operating Conditions during Test
$E_f = 6.3$ V, $E_{bb} = 120$ V, $E_{cc} = 0$ V, $R_k = 200\,\Omega$, $R_p = 2\,k\Omega$.

Limits	Min	Max	
E_{Rpm} over Vibration-Frequency Range of:			
3 to 6 kc/s.	-	35	mV
6 to 15 kc/s.	-	700	mV

LIFE TESTS

Heater Cycling

Duration of Test . . . . 2000 cycles

Operating Conditions

E_f = 8.5 V cycled 1 minute ON and 2 minutes OFF, E_{hk} = −180 V continuously ON.

Rejection Criteria

Heater-Cathode Shorts, and Heater and Cathode Discontinuities.

Intermittent Operation (2, 20, 100, 500, and 1000 Hours)

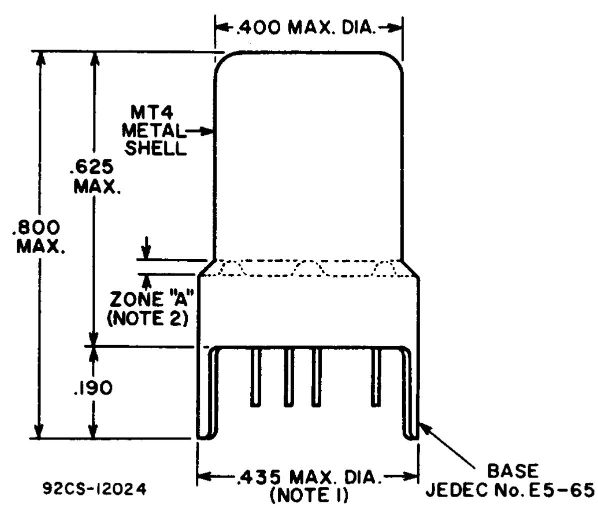
Operating Conditions

E_f = 6.3 V cycled 110 minutes ON and 10 minutes OFF, E_b = 120 V, E_{cc} = −1 V, E_{hk} = 100 V, R_k = 0 Ω, R_g = 1 MΩ, P_b = 0.3 W (approx.), T_E = 150°C min.

End-Point Limits *At*	*2 and 20*		*100*		*500*		*1000*		*h*
	Min	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	
g_m	–	–	2000	–	–	–	–	–	μmho
$\Delta g_m/t$.	–	±10	–	–	–	–	–	–	%
$\Delta E_{Rp}/t$	–	–	–	–	–	±10	–	±15	%
Avg $\lvert\Delta E_{Rp}/t\rvert$. . . .	–	–	–	–	–	7	–	10	%
I_c	–	–	–	−0.05	–	−0.1	–	−0.1	μA
I_{hk}.	–	–	–	–	–	±10	–	±10	μA

DIMENSIONAL OUTLINE

JEDEC No. 4-4

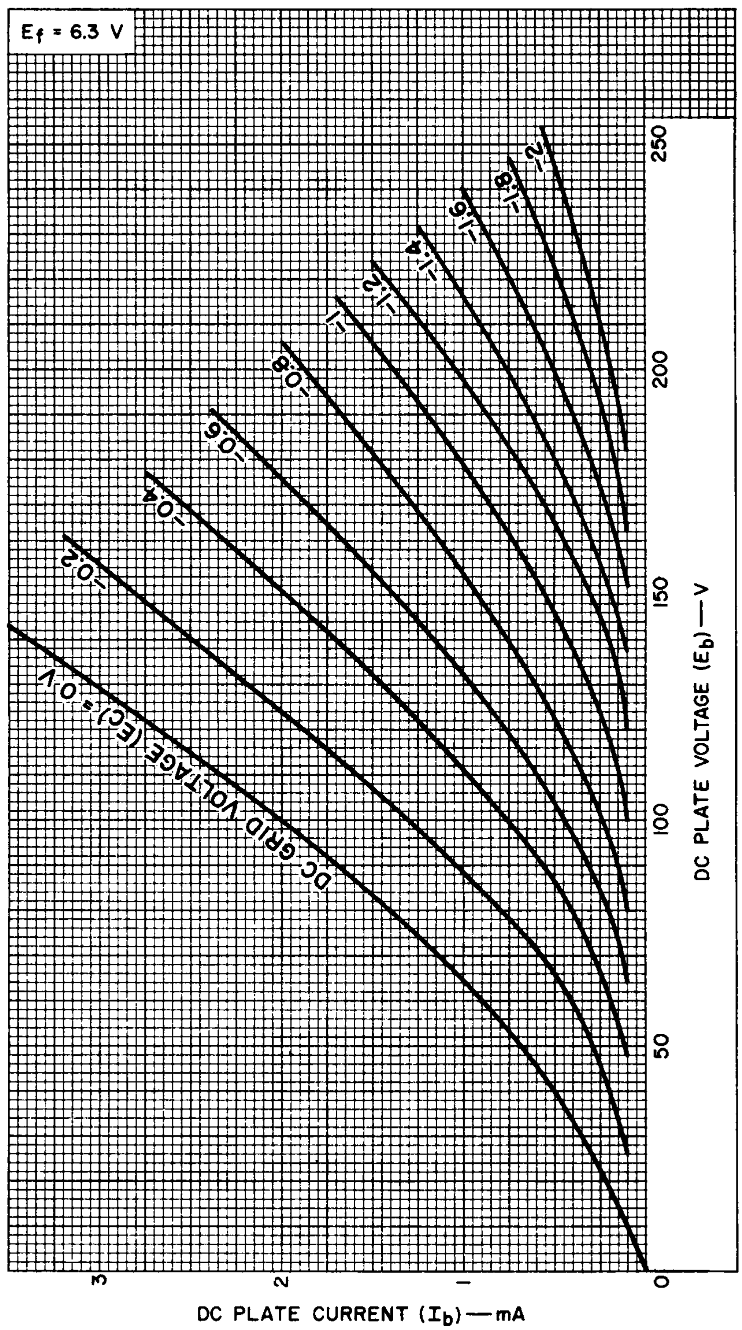


DIMENSIONS IN INCHES

Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

Note 2: Envelope temperature should be measured in zone "A".

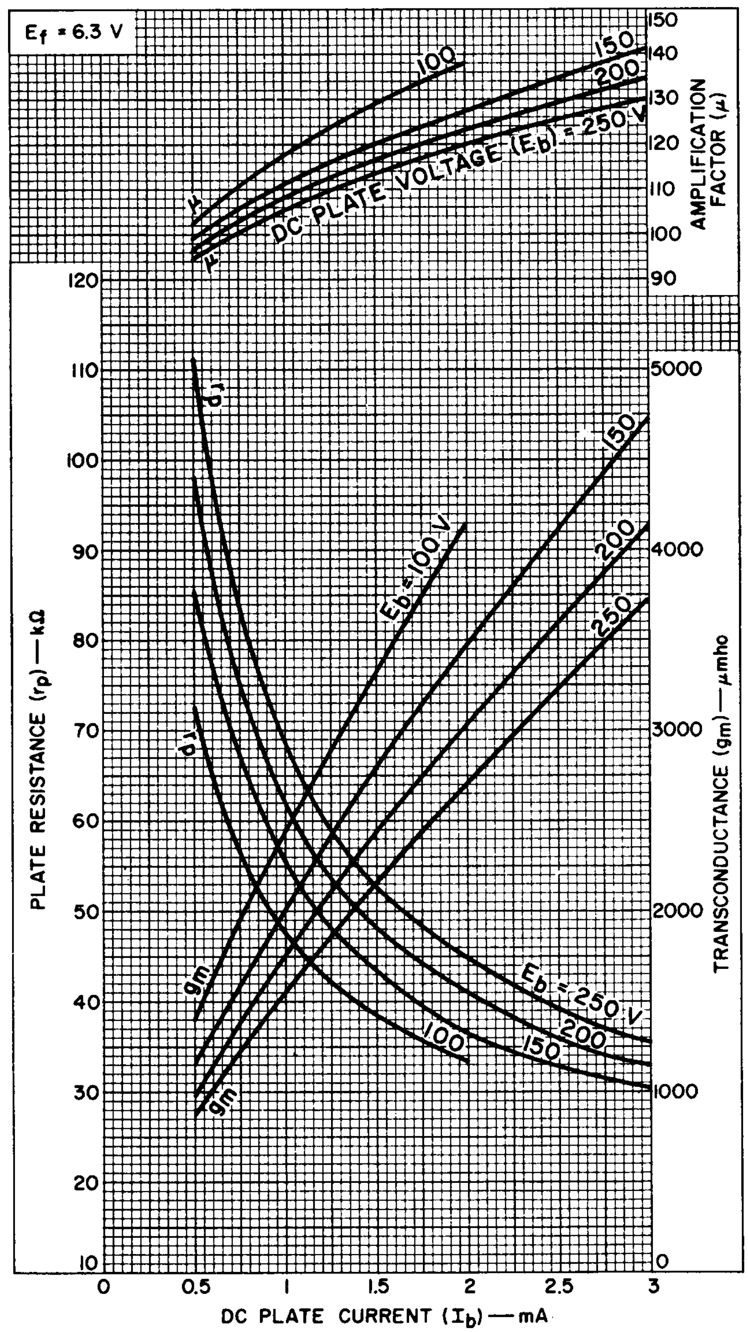
Typical Plate Characteristics



92CM-13213

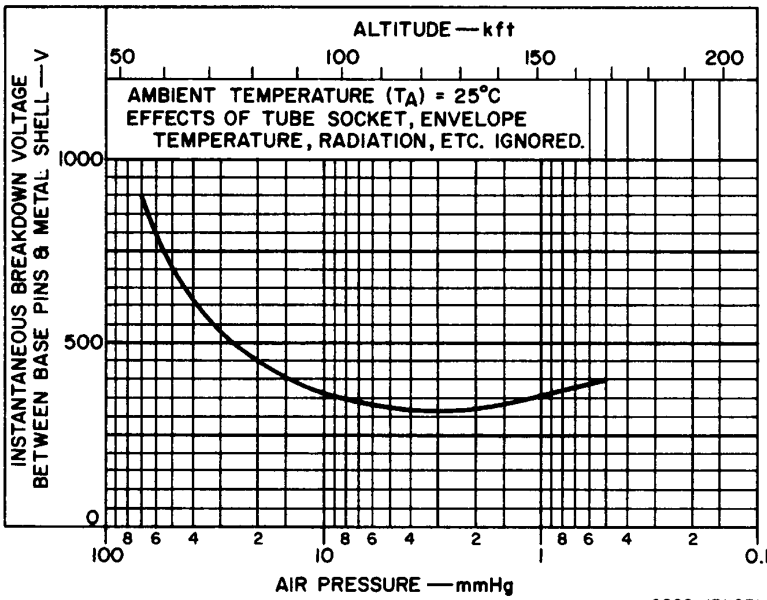
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Typical Characteristics



92CM-13214

Breakdown-Voltage Characteristic



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